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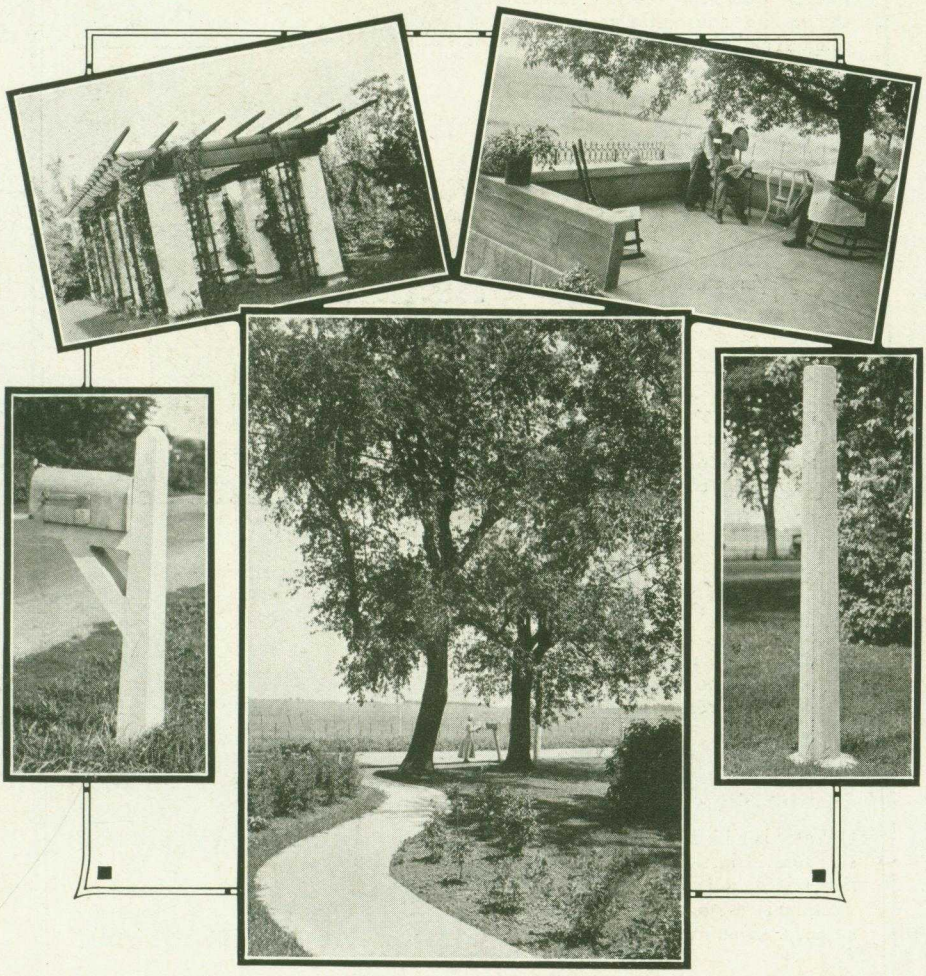
Concrete around the Home



Published by

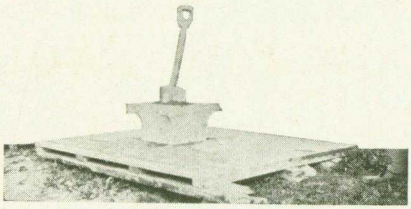
Portland Cement Association

Chicago

How to Mix Concrete by Hand

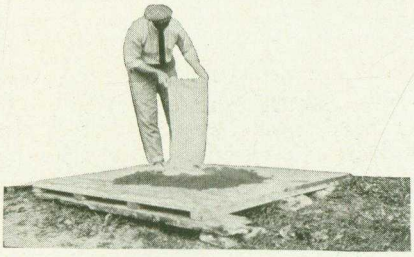
1. Fine Aggregate

Clean sand is measured in the measuring box and spread on the mixing platform. The platform should be substantially made of tongued and grooved boards.



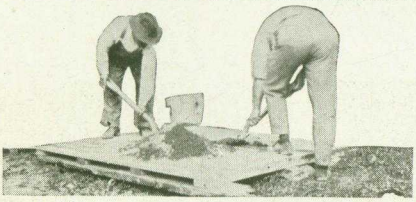
2. Portland Cement

A sack contains one cubic foot. The right amount of cement is spread over the fine aggregate. Don't guess at quantities. See page 7 for proportions.



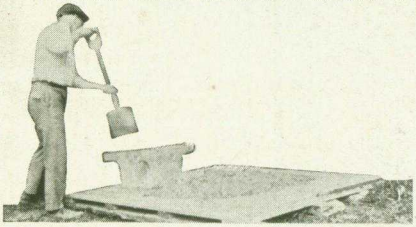
3. Mixing

Fine aggregate and cement are thoroughly mixed by turning over with shovels until the color is uniform before adding coarse aggregate and water.



4. Coarse Aggregate

Pebbles or broken stone are measured in the same way, spread on top and the mixing process repeated until the color is again uniform.



5. Water

Water is added slowly in a depression formed in the center of the pile and mixed as it is added until the mixture is a quaky, jelly like consistency. Don't use too much water.

6. Place at Once

When the concrete is thoroughly mixed place it at once in the forms. The hardening process begins immediately and the concrete must not be disturbed once it is well under way.

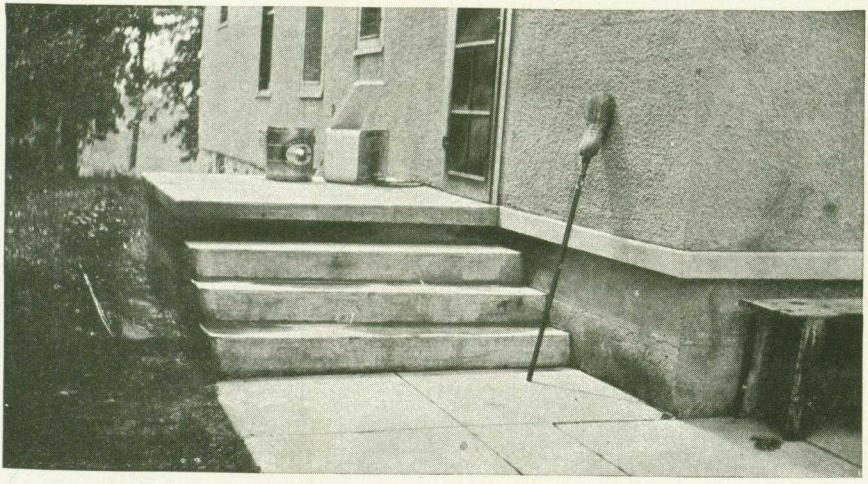
7. Curing

As soon as it is placed protect the concrete against drying out by covering. When hard enough to resist finger impressions sprinkle with water and keep it moist for several days. Get special instructions for protecting in cold weather. See page 11.

Concrete Around the Home

This is an age of concrete. For farm and home, school and hospital, factory and hotel, public and private works, concrete is being used to an increasing extent. In foundations, walls, floors, pavements, posts, tanks, as well as for countless special uses, concrete construction is recognized as the best.

Wherever structural strength is required in combination with permanence, wearing qualities, watertightness and fire safety, there concrete serves as no other material can. And in addition, concrete is low in first cost, sanitary in a high degree, an effective barrier against rats and vermin, attractive in appearance and the most economical of all materials to maintain. These qualities coupled with the wide distribution of the materials entering into its composition and the ease with which it may be prepared, account for the universal popularity of concrete for all kinds of construction.



Concrete steps and porches for the back of the house make keeping things clean an easy task. Once installed, they will serve as long as the house lasts.

The following list is suggestive of the many improvements around the home for which concrete is particularly suited:

Basement floors
Benches
Cisterns
Clothesline posts
Cold frames
Driveways
Fence posts
Flower boxes
Foundations
Garages
Gate posts
Hotbeds
Laundry tubs
Porches
Porch piers
Septic tanks
Steps
Tree surgery
Walks
Well curbs and covers
Weights

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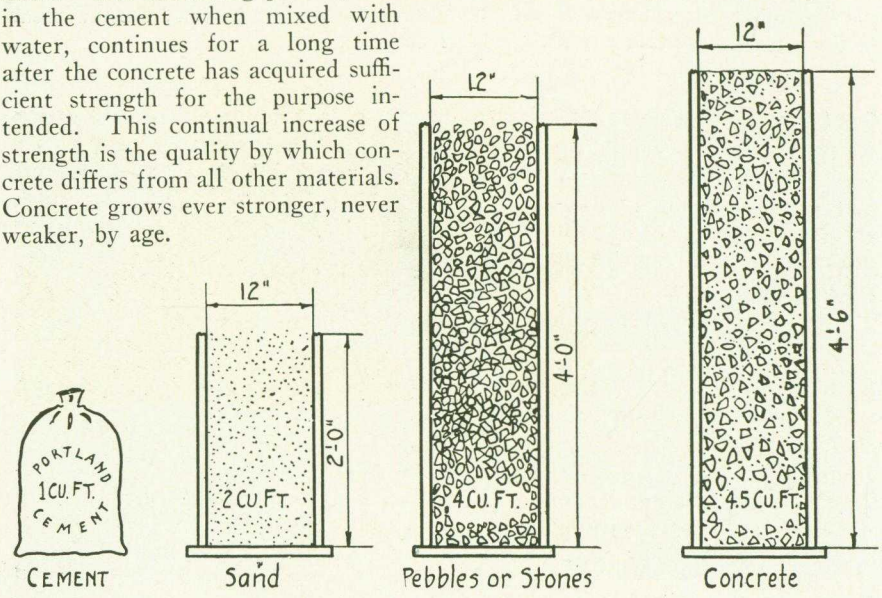
The cost of the materials needed for making good concrete is usually less than for any other permanent building material. Sand and pebbles, which constitute the bulk of the materials required, can usually be obtained locally; and the cement is carried in stock by local dealers.

Anyone who is careful to observe the simple rules for doing concrete work such as that outlined in this booklet can make and place concrete satisfactorily, even though he may have had no previous experience.

What Concrete Is

Concrete is made by mixing portland cement, sand, pebbles or broken stone and water in certain definite proportions, according to the kind of work for which the concrete is to be used, and then permitting the mixture to harden under proper conditions in forms or molds. As soon as concrete has been mixed, if left undisturbed, it begins to harden and soon becomes like stone. The hardening process, which is a chemical change that takes place in the cement when mixed with water, continues for a long time after the concrete has acquired sufficient strength for the purpose intended. This continual increase of strength is the quality by which concrete differs from all other materials. Concrete grows ever stronger, never weaker, by age.



Cement, sand and pebbles in the proper proportions when mixed with water harden into the solid mass that is concrete. Note that 1 cu. ft. of cement, 2 cu. ft. of sand and 4 cu. ft. of pebbles do not make 7 cu. ft. of concrete, but 4.5 cu. ft.

Theory of Mixing Concrete

Pebbles, sand and cement must be mixed together in correct proportions in order to make a dense, strong concrete.

For this reason, in mixing concrete, stone and sand are used in such proportions that the amount of spaces or voids between them is as small as possible, and all the surfaces of the sand and pebbles are coated with a film of cement. The smaller the voids are, the stronger and more dense will be the concrete. A dense concrete is also watertight; if the voids are not all

completely filled, the concrete will be porous and will not be impervious to water.

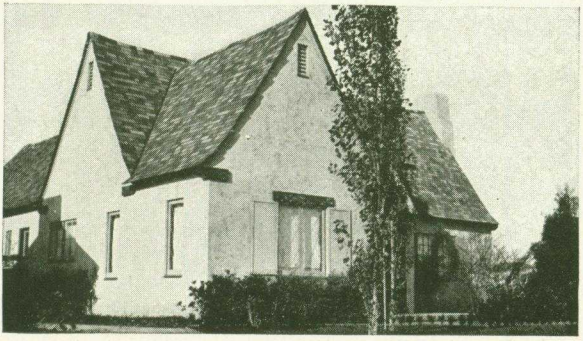
It is very important that no dirt or finely powdered sand be used, as the use of such material interferes with the action of the cement in hardening. The strength of the concrete depends upon the adhesion of the cement mixture to the clean surfaces of sound, hard particles of sand or stone.

Portland Cement

Portland cement is a uniform, reliable product. Any of the standard brands produced by members of the Portland Cement Association are tested and guaranteed and will produce good concrete when properly combined in correct proportion with the other materials necessary for a concrete mixture.

Portland cement is packed and shipped in standard cloth sacks or in paper bags holding 94 pounds net weight. For convenience in determining the necessary quantity of the several materials entering into a concrete mixture, a sack of portland cement may be considered as one cubic foot.

Practically all building material dealers handle portland cement. Cloth sacks are charged to the cement purchaser. When empty they should be returned to the cement dealer, who will buy them back if they are fit for further use as cement containers. Cement sacks which have been wet, torn or otherwise rendered unfit for use are not redeemable.



The concrete or stucco finished house has beauty and charm. Upkeep expenses are reduced to the minimum.

Paper bags are not returnable.

Cement should always be kept in a dry place until used.

Aggregates

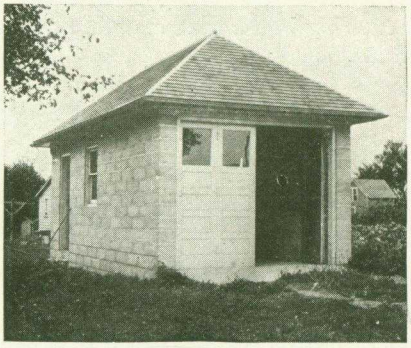
Sand and pebbles or broken stone are usually spoken of as "aggregate." Sand is called "fine aggregate" and pebbles or crushed stone "coarse aggregate." Sand or other fine aggregate, such as rock screenings, includes all particles from very fine (exclusive of dust), up to those which will just pass through a screen having meshes ¼ inch square. Coarse aggregate includes all pebbles or broken stone ranging from ¼ inch up to 1½ or 2 inches. The maximum size of coarse aggregate to be used is governed by the nature of the work. In thin slabs or walls the largest pieces of aggregate should never exceed one-third the thickness of the section of concrete being placed.

Sand should be clean and hard, free from fine dust, loam, clay and vegetable matter. These "foreign" materials are objectionable because they prevent adhesion between the cement and sound, hard particles of sand aggregate,

thereby reducing the strength of the concrete and increasing its porosity. Concrete made with dirty sand or pebbles hardens very slowly at best and may never harden enough to permit the concrete to be used for its intended purpose.

Sand

Sand should be well graded, that is, the particles should not all be fine nor all coarse, but should vary from fine up to those particles that will just pass a screen having meshes ¼ inch square. If the sand is thus well graded the finer particles help to occupy the spaces (voids) between the larger particles, thus resulting in a denser concrete and permitting the most economical use of cement in filling the remainder of the voids or air spaces and binding the sand particles together.



The money invested in your car will receive good protection if you keep your car in a permanent, fire-safe, concrete block garage.

Coarse Aggregate

Pebbles or crushed stone to be used in a concrete mixer should be tough, fairly hard and free from any of the impurities that would be objectionable in sand. Stone containing a considerable quantity of soft, flat or elongated particles should not be used.

Bank-Run Gravel

The natural mixture of sand and pebbles as taken from a gravel bank is usually referred to as bank-run material. This is not suitable for concrete unless first screened so that the sand may be separated from the pebbles and the two materials reproportioned in correct ratio. Most gravel banks contain either more sand or more pebbles than desirable for a concrete mixture. Usually there is too much sand.

Water

Water used to mix concrete should be clean, free from oil, alkali and acid. In general, water that is fit to drink is good for concrete.

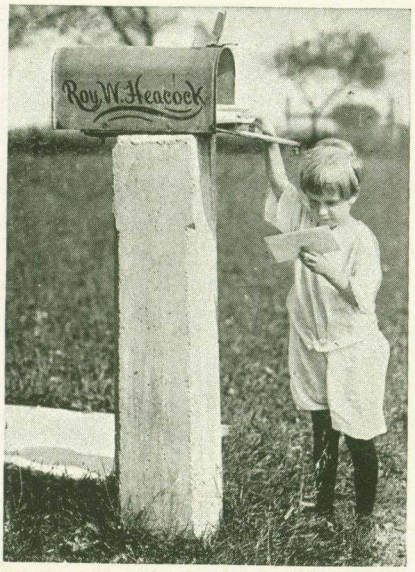
Proportioning Concrete Mixtures

In order to obtain a strong, dense, durable concrete, the materials entering into it must be definitely proportioned. For a given purpose, a certain quantity of portland cement with a certain quantity of sand, pebbles or crushed rock and water will make the best concrete. The several materials entering into concrete must be so proportioned that the cement will fill the voids or air spaces in the sand and when combined with the correct quantity of water will coat every particle of sand, thus making a volume of cement-sand mortar

slightly in excess of the volume required to fill the air spaces or voids in the volume of broken stone or pebbles to be used. Some concrete work requires denser concrete than other kinds, so it is good practice to vary the mixture according to the job.

A 1:2:3 mixture means 1 sack (1 cubic foot) of cement, 2 cubic feet of sand and 3 cubic feet of pebbles or crushed stone. The first figure stands for the cement, the second for the sand and the third for the pebbles or broken stone. A 1:2 mixture means 1 sack (1 cubic foot) of portland cement and 2 cubic feet of sand. A 1:2 mixture would be called a mortar, since it contains no pebbles or broken stone (coarse aggregate).

The following table shows the usual proportions recommended for several classes of construction:

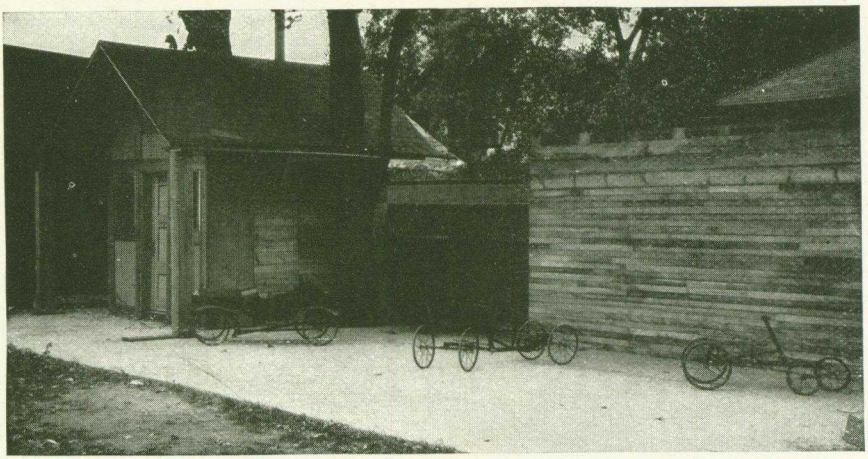


A permanent mail box post can be made in much the same manner as a fence post.

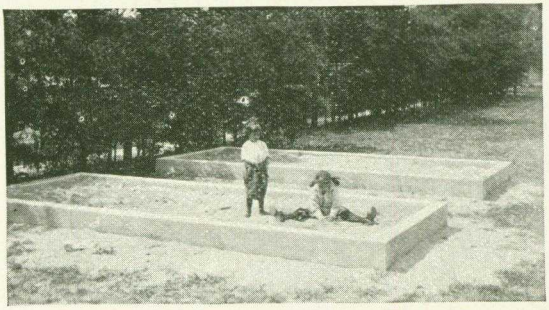
Table of Recommended Mixtures and Maximum Aggregate Sizes

	Max. Size Agg.
1:1:1½—Mixture for:	
Wearing course of two-course pavements	¾ in.
1:2:3 —Mixture for:	
One-course walks, porch and basement floors, pavements and steps	1½ in.
Basement walls exposed to moisture	1½ in.
Fence posts, clothesline posts, gate posts, benches	¾ in.
Sills and lintels without mortar surface	¾ in.
Wells and cisterns, watering troughs and septic tanks	1 in.
1:2:4 —Mixture for:	
Foundations for farm machinery	2 in.
Concrete work in general	1½ in.
1:2½:4—Mixture for:	
Coal bins, grain bins, silo walls and similar structures	1½ in.
Building walls above ground	1½ in.
Walls of pits or basements	1½ in.
Base of two-course floor or pavement	2 in.
1:2 —Mixture for:	
Wearing course of two-course walks, floors and pavements	¼ in.
Flower boxes	¼ in.

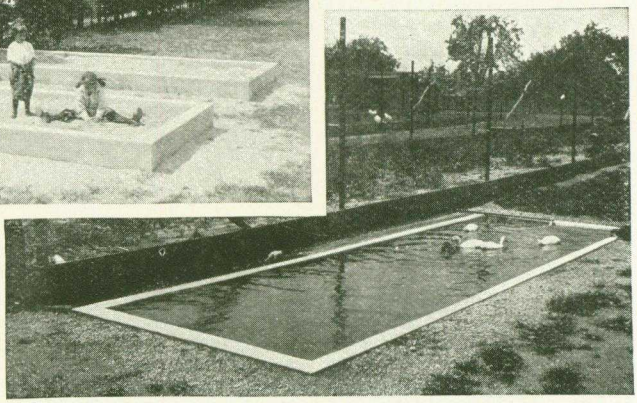
Concrete in the Playground

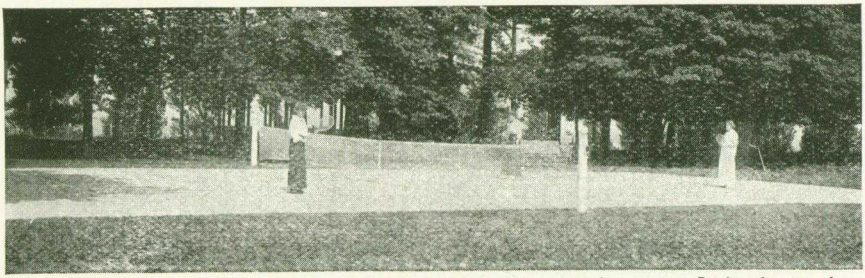


Children find abundant use for the clean, dustless surface of a paved playground like this.



Sand boxes keep the children out of doors and when they grow up are easily made into flower beds or fish ponds.





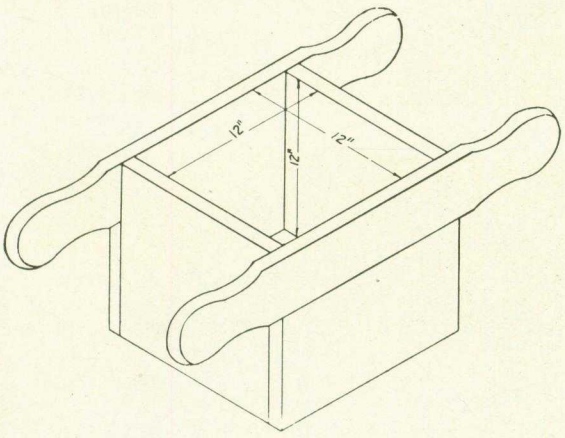
As soon as the rain stops you may play on your concrete tennis court. It is always clean and white.

Don't Guess at Quantities

All materials should be accurately measured. This can be done easily by using a measuring box made to hold exactly 1 cubic foot, 2 cubic feet or any other volume desired. Such a box is in reality a bottomless frame. An illustration of a measuring box is shown below. To measure the materials the box is placed on the mixing platform and filled. When the required amount of material has been placed in it, the box is lifted off and the material remains on the platform. Cement need not be measured because, as already explained, one sack can be considered as 1 cubic foot in volume. A pail might also be used in proportioning concrete. For example, a 1:2:3 batch of concrete would be measured by taking 1 pail of portland cement, 2 pails of sand and 3 pails of pebbles or stone.

Mixing the Materials

Concrete may be mixed either by hand or by machine. Machine mixing is to be preferred, as in this way thorough mixing is easier to obtain and all batches will be uniform. However, first-class concrete can be mixed by hand. Whichever way mixing is done, it should continue until every pebble or stone is completely coated with a thoroughly mixed mortar of sand and cement.



Bottomless measuring box of one cubic foot capacity for determining the exact batch proportions.

Mixing Platform

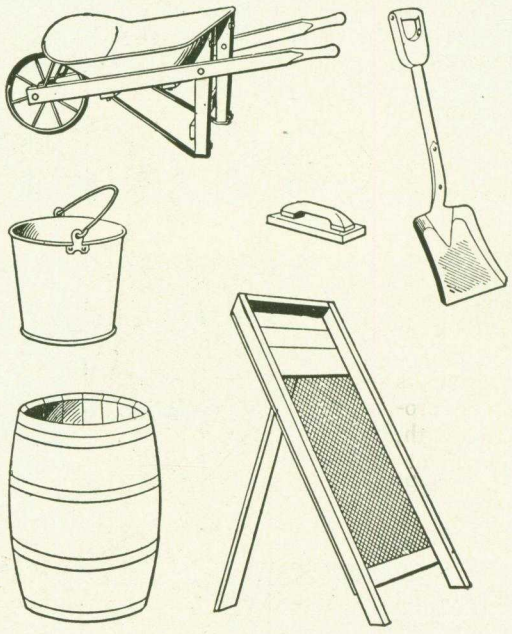
For hand mixing a watertight platform at least 7 feet wide and 12 feet long should be provided. A platform of this size is large enough to permit two men using shovels to work upon it at one time. Such a platform should preferably be made of boards at least 1½ inches thick, tongued and grooved so that joints will be tight and the platform rigid. These planks may be nailed to three or more 2 by 4's set on edge. Two sides and one end of the platform should have a strip nailed along the edge and projecting 2 inches above the mixing surface of the platform to prevent materials from being washed or shoveled off while mixing.

Hand Mixing

The usual procedure in mixing concrete by hand is as follows:

The measured quantity of sand is spread out evenly on the platform. On this the required amount of cement is dumped and evenly distributed. The

cement and sand are then turned over thoroughly with square pointed shovels enough times to produce a mass of uniform color, free from streaks of brown and gray. Such streaks indicate that the sand and cement have not been thoroughly mixed. The required quantity of pebbles or broken stone is then measured and spread in a layer on top of the cement-sand mixture and all of the materials again mixed by turning with shovels until the pebbles have been uniformly distributed throughout the mixed cement and sand. At least three turnings are necessary. A depression or hollow is then formed in the center of the pile and water added slowly while the materials are turned with square pointed shovels, this turning being continued until the cement, sand and pebbles have been thoroughly and uniformly combined and the desired consistency or wetness obtained throughout the mixture.



Simple tools for making and placing concrete: Water barrel and bucket; steel pan wheelbarrow for handling dry aggregate, and concrete to forms; sand screen for proper grading of aggregates; square pointed shovel for turning and mixing concrete, and wooden float for finishing.

It is very important that no more water be used than necessary, as too much will reduce the strength of the concrete. Too little water will also reduce its strength and make it porous. For general use, concrete, after thorough mixing, should be wet enough to form a mass of pasty or jelly-like consistency, but never so wet as to flow easily or be soupy.

Placing Concrete

Concrete should be placed in the forms as soon as possible after mixing, and in no case more than 30 minutes after mixing. It should be deposited in layers of uniform depth, usually not exceeding 6 inches. When placed in the forms it should be tamped and spaded so as to cause it to settle thoroughly everywhere in the forms and produce a dense mass. By "spading" is meant the working of a spade or chisel-edge board in the concrete and between it and the side of the forms, moving the spading tool to and fro and up and down. This working of the concrete next to the forms forces the large pebbles or stone particles away from the form face into the mass of the concrete and insures an even, dense surface when forms are removed.

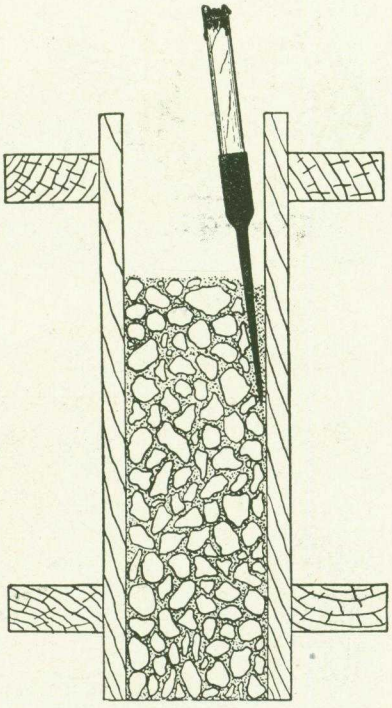
Finishing Concrete

The surface of a floor or walk should be finished by using a wood float. A metal trowel should be used sparingly, if at all, because its use brings a film of cement to the surface, which lacks the wearing quality of the cement and sand combined and may cause the surface to develop "hair cracks" after the concrete hardens. A trowelled surface is smoother, but does not wear so well as a floated surface and is likely to be slippery.

Protecting Newly Placed Concrete

If concrete is left exposed to sun and wind before it has properly hardened, much of the water necessary to hardening will evaporate and the concrete will simply dry out. Moisture is necessary to the proper hardening of concrete because, as already mentioned, the hardening process is a chemical change which takes place in the cement when mixed with water.

Concrete floors, walks, pavements and similar large surfaces can be protected by covering with moist earth, sand, or other moisture-retaining material as soon as the concrete has hardened sufficiently to permit doing so without marring the surface. This covering should be kept moist in warm weather by frequent sprinkling during a period of ten days or so. Walls or others sections which cannot conveniently be covered in the manner suggested can be protected by hanging moist canvas or burlap over them and wetting down the entire work often enough to keep it always moist for ten days after placing. During cold weather protection is equally important, but the concrete need not be kept moist as evaporation is not so rapid.



"Spading" of concrete in wall forms forces the coarse aggregate back from the face and produces a smooth surface on the finished wall.

Concrete in Winter

There is no difficulty in doing concrete work in cold weather if a few simple precautions are taken. The booklet "Making Concrete and Cement Products in Winter" describes the rules to be followed. A copy may be obtained free by addressing the Portland Cement Association.

Forms

Forms or molds are the receptacles in which concrete is placed so that it will have the desired shape or outline when hardened. Forms are generally constructed of wood and where a smooth surface finish is required, planed lumber is best.

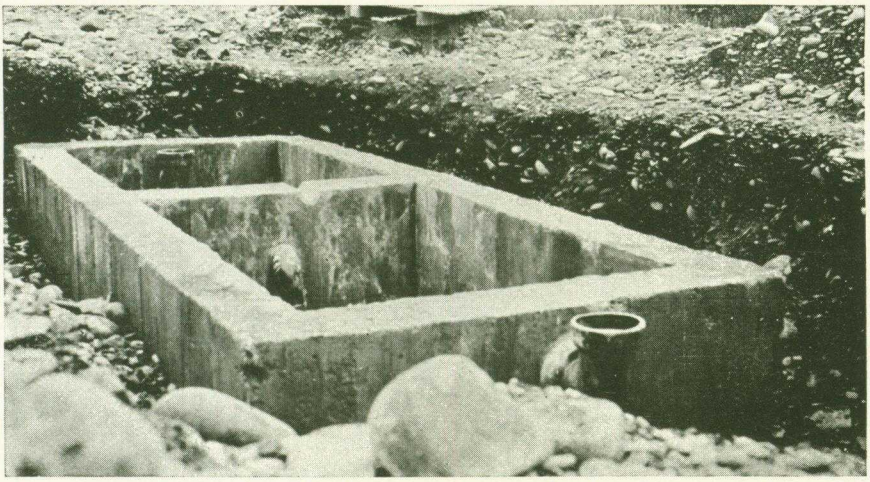
Finished concrete will have no smoother surface than your forms. Rough work forms can be made from rough lumber. For smooth finish work get good dressed lumber and use tongue and groove or shiplap so that the forms will be tight. Even for plain work, lumber that has been dressed at least on one side and on the edges is best because the boards will fit closely together and prevent leakage.

The modern version of the old oaken bucket. A tile lined well with a clean concrete platform means pure water.

Forms should be built up in sections or panels so constructed that they can be easily removed and used again or the lumber in them can be knocked down without injury and used in other work. Contractors often construct forms with special double headed nails or screws instead of with the common wire nails. Forms should be so designed that they can be taken down with the least amount of hammering, thus preventing possible injury to the concrete before it has thoroughly hardened. A steel stripping bar, obtainable at hardware stores or contractors' supply houses, is a useful tool for stripping wood forms from the finished concrete.

For foundation work below ground level forms will not be necessary if the earth is so firm that the sides of the excavation will stand without caving. When placing and tamping the concrete, however, care must be taken not to knock down the earth into the concrete, as this would cause weak and porous spots in the wall.

To prevent adhesion of the concrete to the forms and make their removal easy, the forms should be well greased. Crude oil or soft soap is generally used for this purpose and is applied with a swab or whitewash brush. White-

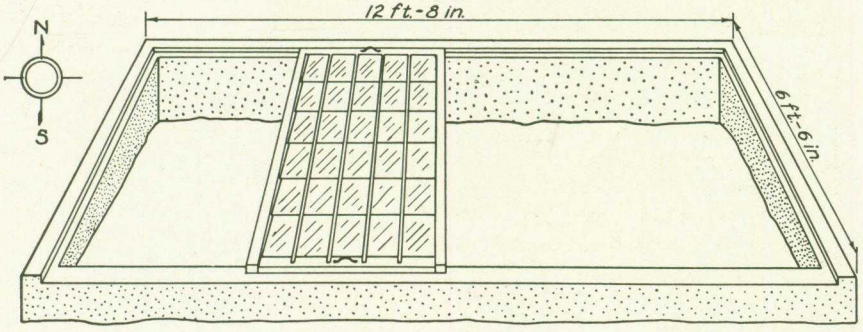


A septic tank that will be good insurance against contamination of the water supply and many contagious diseases is easily made of concrete.

wash is sometimes used as a substitute when oil or soap are not available. Forms should be cleaned of all concrete adhering to them from previous use and should be again oiled before reusing.

With ordinary skill in carpentry, anyone can make forms for common concrete construction, provided care is taken to build them strong and true. If properly designed, forms can be assembled in part by clamps and wedges, and only a few nails partly driven will be needed.

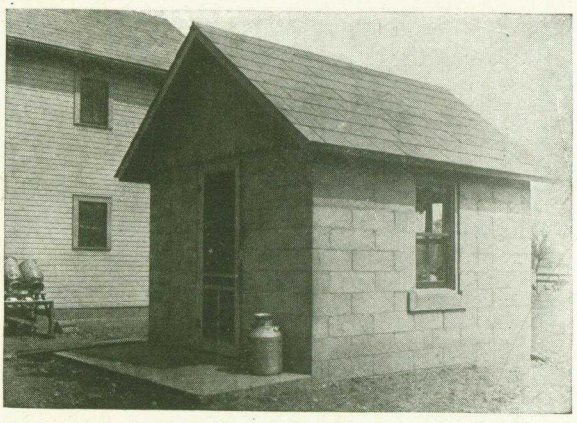
After forms are made they should be set up perfectly plumb and well braced in position so as to withstand the pressure and prevent bulging of the wet concrete while it is being tamped into place. Wood spacers should be used for walls to hold opposite form faces the correct distance apart, and wire



Hotbeds and cold frames when built of concrete are rotproof and permanent. The walls, six inches thick, project above the ground, twenty inches on the north side and eight inches on the south side; and are carried to a depth of three feet. Well rotted manure is placed in the bottom of the excavated interior two feet deep and covered with an eight-inch top of rich soil.

ties passed through or around form studs and across the space between forms to tighten the forms against the spacers and hold them in true alignment so that the finished wall will be straight and even in thickness.

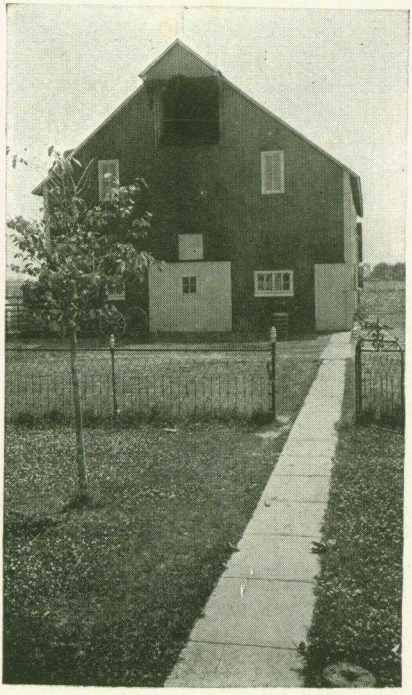
Wire ties are tightened by twisting. Spacers must be removed as concreting progresses, as otherwise a permanent blemish in the wall will result.



The concrete block milk house is naturally clean and sanitary and easy to build.

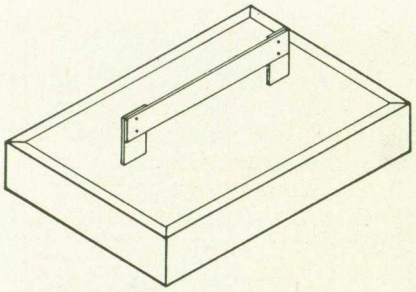
Removal of Forms

Forms must not be removed or "stripped" until the concrete has thoroughly hardened. The time required cannot be definitely stated as so much depends on the nature of the work and local temperature and weather conditions.



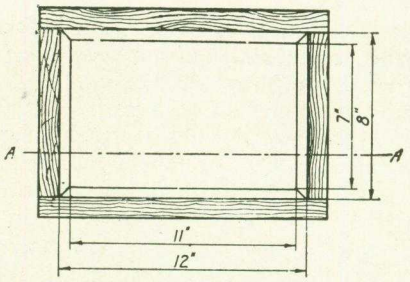
No one will appreciate concrete walks more than the women who keep house and sweep the floors in muddy weather.

In summer weather wall forms can generally be stripped after two days and in colder weather from four to seven days. Floors over basements, roofs and other parts should not be stripped in less than seven days in summer and fourteen days in colder weather. If the concrete is still soft or yielding it should on no account be stripped, and if it has frozen it must be left in the forms until it has thawed and then watched to see if it will harden properly. Heat hastens and cold delays the hardening of concrete. At a temperature of 80 degrees F. concrete hardens rapidly. At temperatures below this the rate of hardening decreases. When the temperature is around 50 degrees, the process of hardening is noticeably retarded and at the freezing point ceases. Under conditions favorable for hardening, concrete soon acquires sufficient strength to be safe against damage. The warmer it is kept the sooner will it reach this degree of hardness.

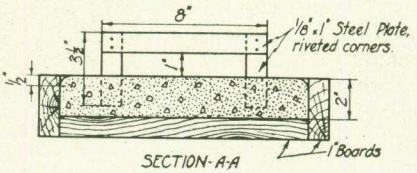


ISOMETRIC VIEW OF SCRAPER

A portable concrete foot scraper can be easily made and will be much welcomed by the housewife.



TOP VIEW OF FORM



SECTION-A-A

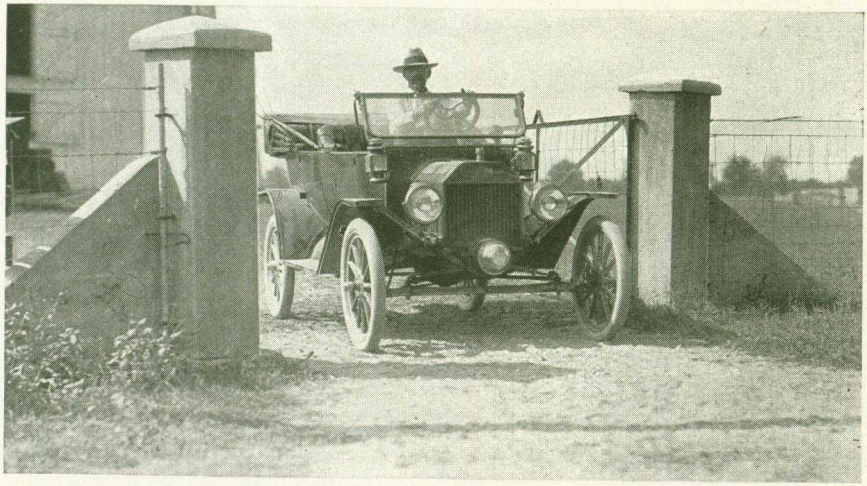
Never remove forms until it is certain that the concrete has hardened.

Frozen Concrete

Many accidents are caused by mistaking frozen concrete for properly hardened concrete, because it may have the same "ring" when struck with a hammer. A reliable test for determining whether concrete is frozen instead of properly hardened is to apply hot water or steam to the surface. If frozen, it will soften, but if properly hardened it will be unaffected by the heat.

Reinforced Concrete Requires Engineer to Design

Reinforcement is the term used to describe the steel rods that are placed in the concrete to increase its tensile strength. Concrete is a material that, like stone, is strong in compression, that is, very strong in bearing loads that



Gate posts of concrete make a substantial, permanent entrance to any farm and insure tight fences and solid gates.

are placed directly upon it, but is relatively weak in tension, so steel rods or wires are placed in the concrete to increase its power to resist strains that tend to bend it or pull it apart. It is very important that this steel reinforcement be placed in the correct position; that is, in that part of the concrete mass where it will be most effective in resisting the tensile stresses. For example, in a concrete lintel or beam the reinforcement is placed near the lower side as that is the side which tends to pull apart when the beam is loaded. The reinforcement of fence posts, troughs and stock watering tanks is explained in subsequent paragraphs; but more important or elaborate structures such as floors above ground, beams, columns, retaining walls, silos and other buildings should be designed by an experienced engineer.

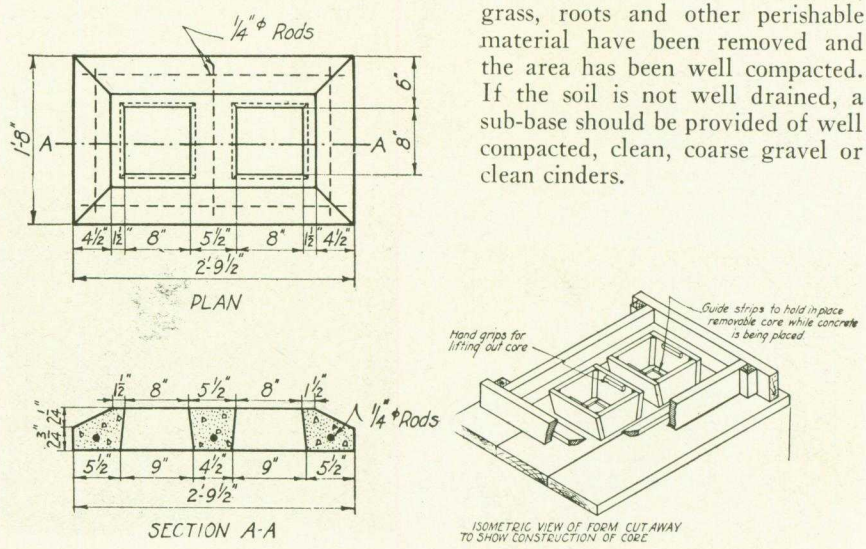
Placing Reinforcement

The steel reinforcement should be placed accurately in position before concrete is deposited in the forms and tied firmly in place by wire hoops or ties twisted around them.

Concrete Walks, Floors and Pavement Construction

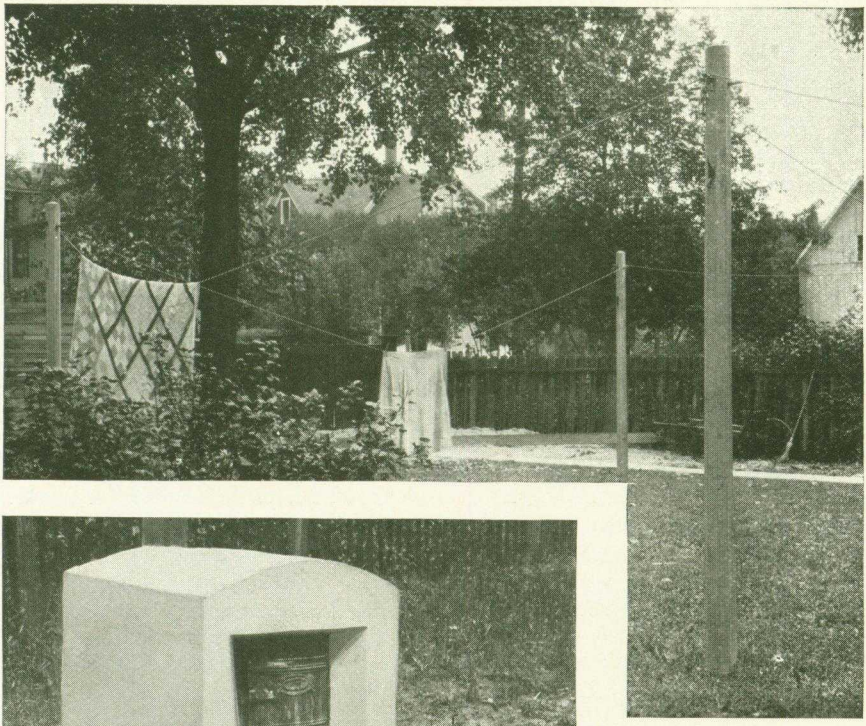
The beginner need not hesitate to build concrete walks or floors, or do similar concrete work after he has carefully read the directions in this booklet. The principles which apply to the construction of a concrete walk apply also to the construction of a floor, as a floor is in all essentials like a number of sidewalks placed side by side.

Walks, floors and pavements should always rest on a good firm base. If the soil on which they are to be laid is well drained, the concrete can be placed directly on it after all loam, refuse, grass, roots and other perishable material have been removed and the area has been well compacted. If the soil is not well drained, a sub-base should be provided of well compacted, clean, coarse gravel or clean cinders.

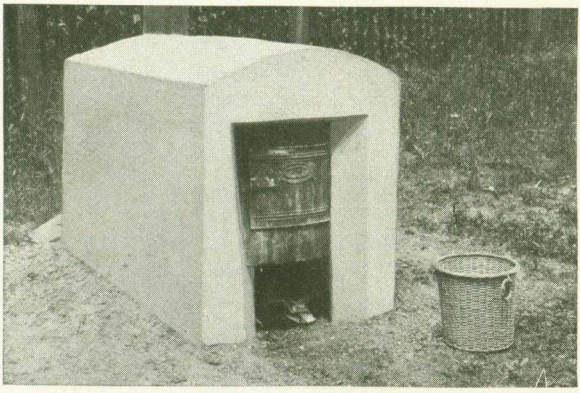


This simple form for the construction of chimney caps can be taken apart and used a great number of times.

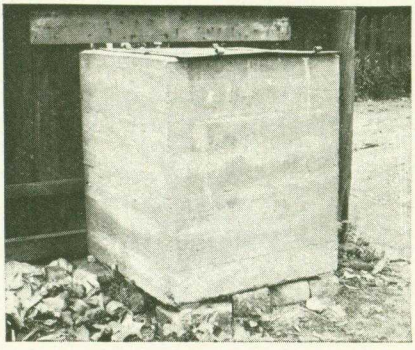
Concrete Around the Back Door

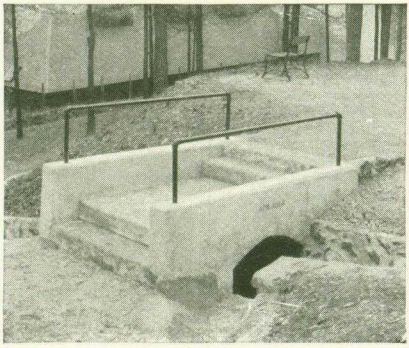


Permanent, rotproof concrete clothesline posts help keep the back yard tidy.



Concrete refuse burners and ash receptacles are sanitary conveniences that are easy to make.





Concrete culverts are permanent improvements always clean and solid.

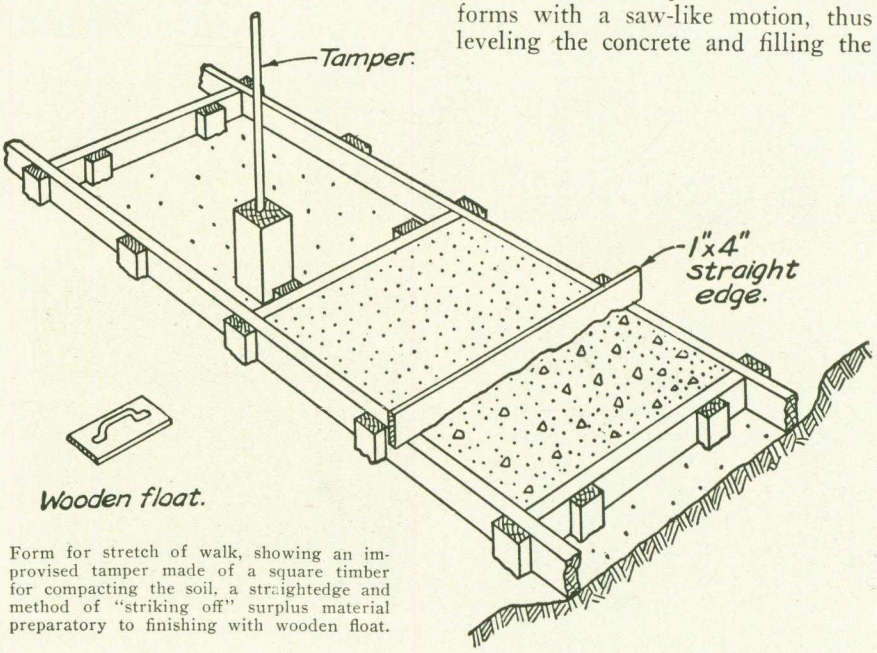
Usually, 2 by 4's securely staked in position are used as side forms for walk construction. Pavements are laid either as one-course construction or as two-course construction. One-course construction means that the full thickness of the walk or pavement is placed at one time, using one standard concrete mixture throughout. In two-course construction the pavement is laid in two courses, using a certain mixture for the base and another (usually a mortar) for the top or wearing surface. One-course construction is generally more satisfactory.

Concrete walks and floors should be blocked off with partition strips and concrete placed for alternate slabs. After these have hardened enough to be self-sustaining the cross strips can be removed and the intermediate slabs concreted. The concrete already in place serves as a form for the intermediate slabs.

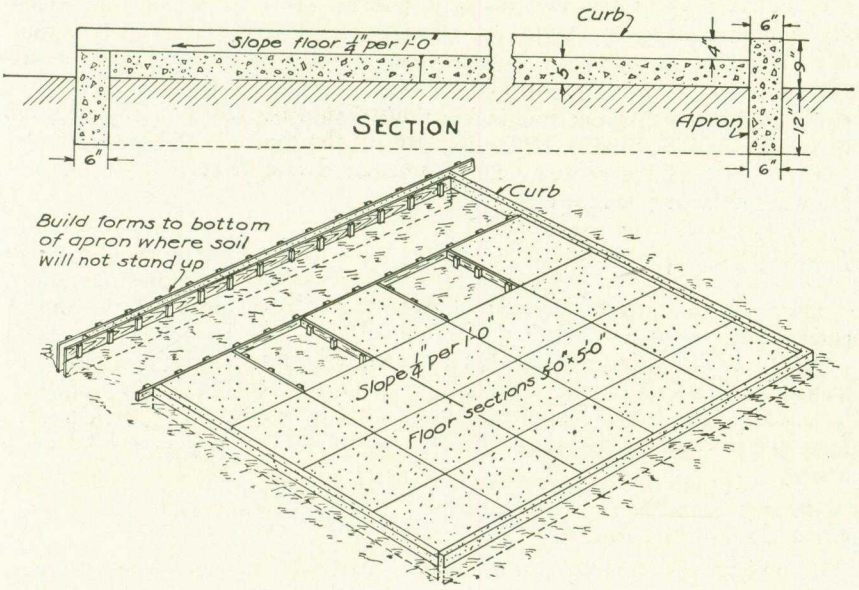
Thickness of walks may vary from 4 to 6 inches according to the service which they must render. If a pavement is to be used only as a walk, 4 inches is generally thick enough, but if wagons are likely to drive over it, 6 inches should be the minimum thickness.

A concrete mixture composed of 1 sack of portland cement, 2 cubic feet of sand and 3 cubic feet of pebbles or broken stone is recommended for walks, floors and similar pavements.

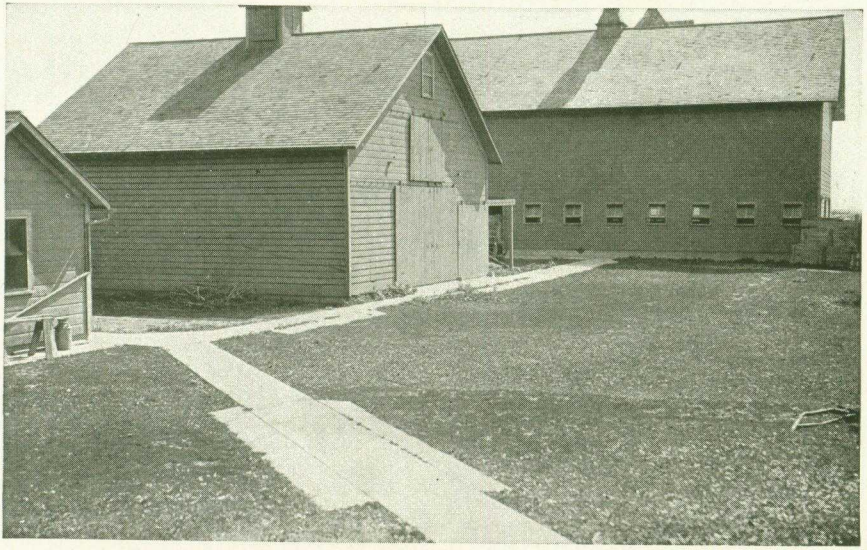
In mixing the correctly proportioned materials, enough water should be added to produce a concrete of pasty or jelly-like consistency so that it can be spread out in the forms and easily leveled with a strikeboard resting on the edge of the forms. This strikeboard should be passed across the forms with a saw-like motion, thus leveling the concrete and filling the



Form for stretch of walk, showing an improvised tamper made of a square timber for compacting the soil, a straightedge and method of "striking off" surplus material preparatory to finishing with wooden float.

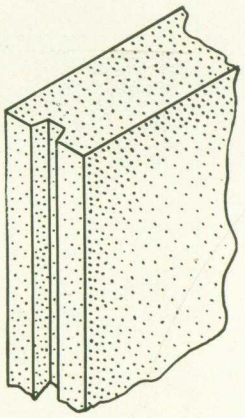


Concrete pavements, whether intended for feeding floors, barnyard pavement, tennis court or playground pavement, soon pay for themselves. This sketch shows method of laying out forms in 5-foot squares, and first filling alternate squares with concrete.



Concrete walks in the barnlot take away the terror of the spring thaw and help keep the kitchen floor clean on rainy days.

hollows, and at the same time assisting to compact it. The walk should be finished with a wood float to produce an even, gritty surface. After the concrete has commenced to harden a cover of moist sand or earth about two inches thick should be thrown on and kept moist for ten days or so. At the end of this time the covering may be removed and the walk or floor put into use.

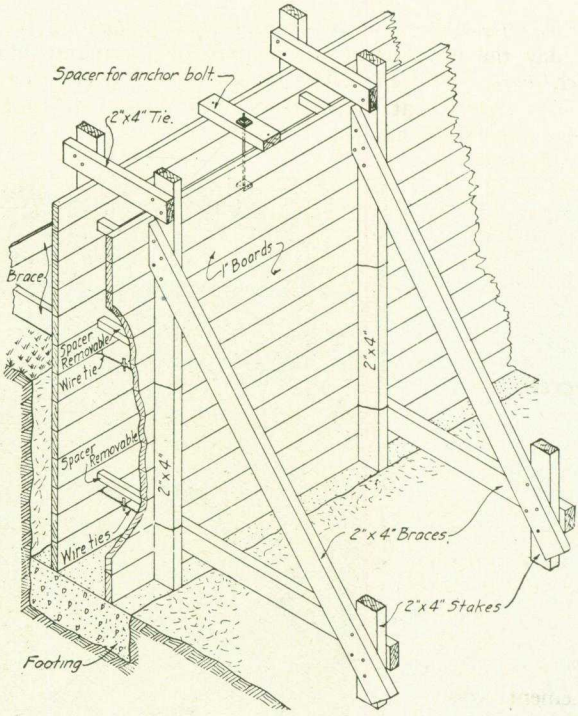


Method of forming vertical construction joints.

Foundations

Every building should have a strong, watertight, permanent, concrete foundation. This should extend down to firm bearing soil so that there will be no danger of settling of the structure it is to carry. The foundation should also extend below possible frost penetration to prevent upheaval due to frost action.

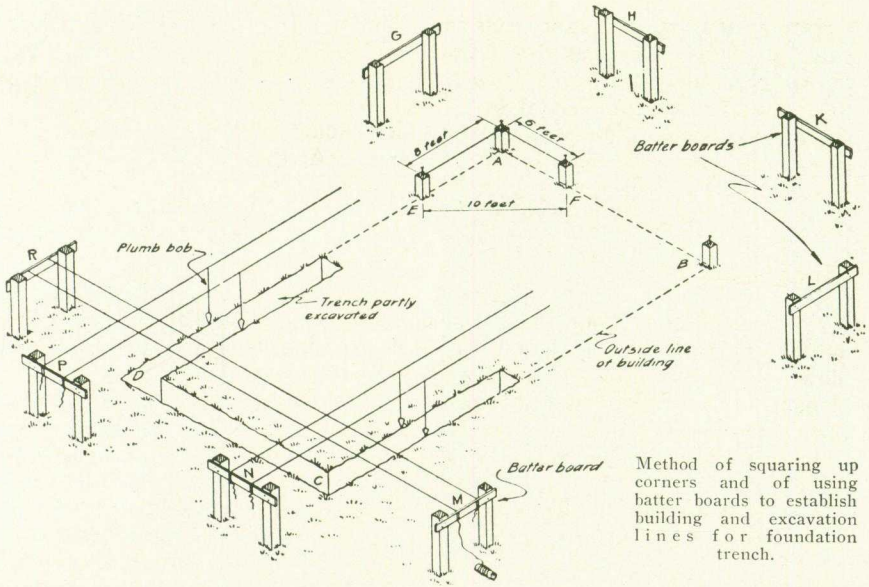
If a foundation located in poorly drained soil is to form part of the enclosure of a basement or cellar a 1:2:3 concrete mixture is recommended to insure watertight construction. For most foundation work a 1:2½:4 or a 1:2½:5 mixture will be satisfactory.



A house is no better than its foundation. This sketch shows how to make the forms for a concrete foundation wall that is solid and permanent.

Construction Joints

Any large piece of concrete work should, if possible, be started early enough to insure its completion the same day and thus avoid construction joints between one day's work and the next. If it is necessary to stop work on a wall or foundation before it is finished the concrete should be brought to a level in the forms and the surface prepared to receive the next day's work by placing pebbles projecting halfway out of the concrete or by roughening the sur-



Method of squaring up corners and of using batter boards to establish building and excavation lines for foundation trench.

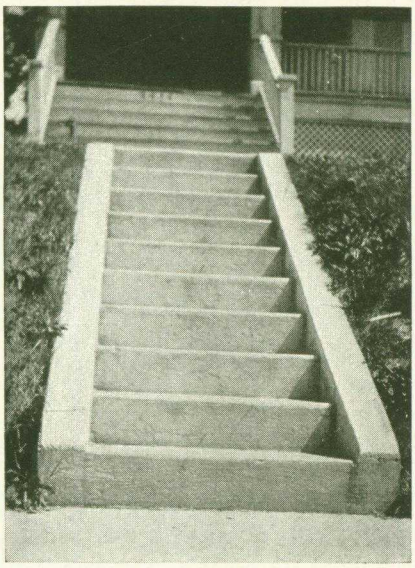
face with a trowel. This will make a better bond. Before concrete work is commenced the next day the top surface of the hardened concrete must be cleaned. If too much water has been used a creamy scum will be found which must be cleaned off. Then coat the surfaces with a paste of cement and water just before new concrete is applied.

If a vertical joint is necessary a groove should be made by a stop board placed in the wall form and removed before the remainder of the concrete is placed, as shown on page 20.

Making Smooth Concrete Wall Surfaces

If a very smooth surface is required on a concrete wall it should be rubbed down as soon as the forms are removed with a carborundum stone to remove all "fins" and irregularities. Porous spots or "stone-pockets" should be filled with cement mortar, after which the wall should be painted with a "cement wash" (cement and water mixed to the consistency of thick cream) rubbed in with either carborundum stone about

Concrete fixtures improve the appearance of any lawn. An old dishpan and a stovepipe served as molds for this neat bird bath.



Concrete steps are safe and easy to keep clean. They do not rot and need no repairs.

the size of a common brick or a brick made of cement and sand. This will produce a smooth surface of even color.

Concrete Steps

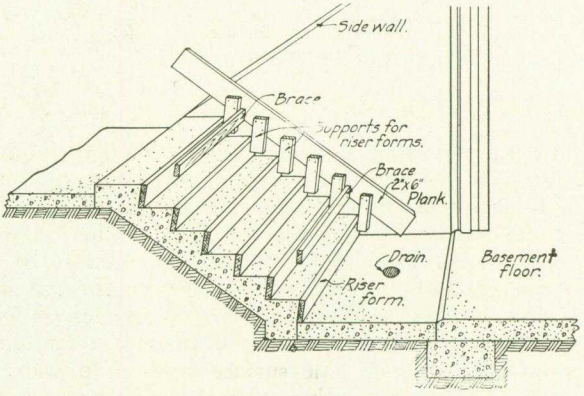
The first place in the house to wear out and decay is the flight of outside wooden steps. Concrete steps will last forever. Every house should have them. They are easily kept clean; they are rotproof and will never become slippery.

Details of form construction of simple concrete steps for the average home are shown in an accompanying illustration. Steps of this kind, resting on well compacted earth, require no reinforcement. Forms consist of planks held firmly in place by means of 1 by 4 crosspieces against the side walls, which are built first. To the planks 1 by 4's are nailed. The length of these pieces is such that they come within 2 inches of the treads. Crosspieces, usually of 1-inch material and 8 inches wide, are nailed to these to make the riser forms. A 1:2:4 concrete mixture is recommended.

Troughs, Tanks and Cisterns

Concrete troughs, tanks and cisterns do not leak, last indefinitely, and are easy to keep clean. They will not rot, rust, warp or wear out. They are always ready for use.

All receptacles for holding liquids must be watertight, therefore a 1:2:3 concrete mixture is recommended for structures of this type. All tanks or troughs should be reinforced either with steel rods or wire mesh. Usually, ¼ to ⅜ inch steel rods are used. The number, size and spacing of rods is governed by the size and shape of the tank; the larger the

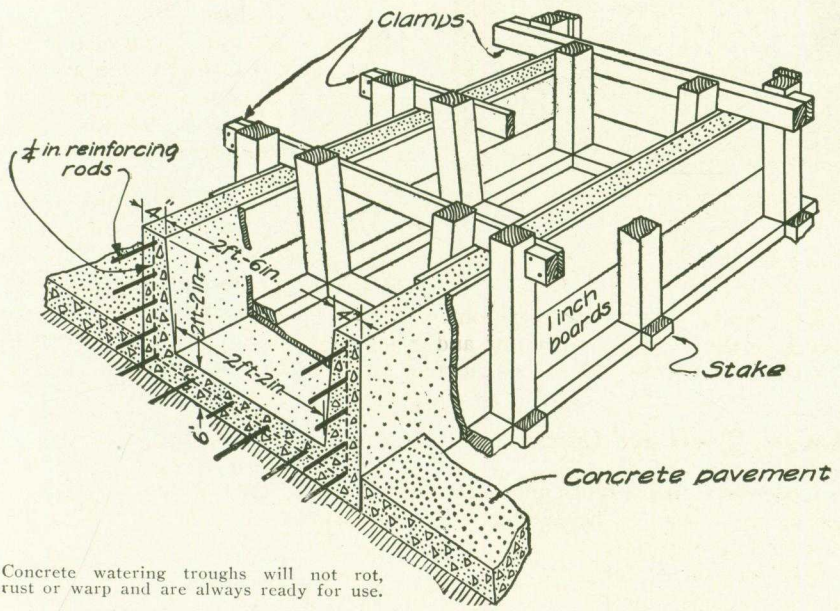


Concrete basement steps are not hard to build by the use of easily made forms as shown in this sketch. This set of steps is an asset to any building.

tank the more reinforcement is required. The illustration below gives the proper amount of reinforcement for a trough and tank of the dimensions shown.

Small troughs like the one illustrated on page 24 can be cast upside down on some level floor or platform. Forms for these handy troughs cost little and can be taken apart and used many times, making them valuable neighborhood property.

The walls of the large watering tank, shown below, are tapered to relieve the wall from pressure of ice should the water freeze. On removal of forms the inside face is given a wash of portland cement and water mixed to the thickness of cream and applied with a brush to close all pores and insure a watertight job.

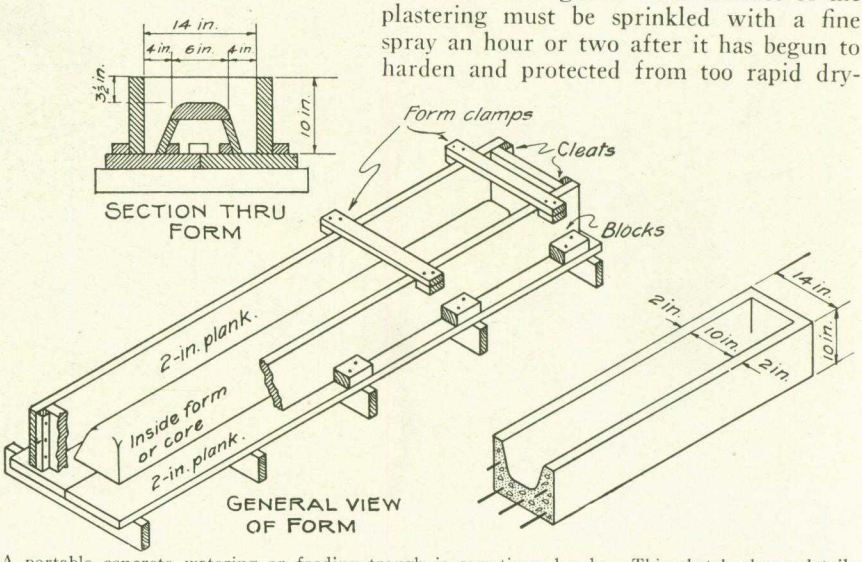


Concrete watering troughs will not rot, rust or warp and are always ready for use.

Repairing Leaky Tanks

Improper mixtures or incorrect construction methods may result in porous spots in the construction of concrete tanks through which contents leak. Such tanks may be repaired by giving the whole interior of the tank a cement plaster coat. If properly applied, this method should remedy the trouble. Preparatory to applying this plaster coat the surface to be treated should be thoroughly cleansed by scrubbing with a good stiff brush and water, or better still, washed with a solution of one part of commercial muriatic acid to three or four parts of water, allowing this to remain for a few moments and then thoroughly rinsing off the surface with clean water. The acid treatment removes the cement coating from the particles of sand and gravel, thus exposing clean surfaces to which the cement plaster will more readily adhere.

The cleaned surface should be painted with a wash of cement and water mixed to the consistency of cream, applied with an ordinary whitewash brush; this should be applied just in advance of the plastering. Before it has commenced to harden, plastering mortar mixed in the proportion of one part cement to one and one-half or two parts of sand should be applied at once. The mixed mortar must be used within thirty minutes, as once it has commenced to harden it will be worthless. Mortar can be applied with a steel trowel, after which the surface should be worked thoroughly and as soon as possible with a wood float to make a dense, impervious coating. Final smoothing may be done with a steel trowel, but overtroweling should be carefully avoided as this will impair the quality of the coating by drawing a film of cement to the surface, thus robbing the mortar coat of uniform distribution of cement throughout. The surface of the plastering must be sprinkled with a fine spray an hour or two after it has begun to harden and protected from too rapid drying out by being kept wet for several days so that the plaster coating will harden thoroughly and uniformly.



A portable concrete watering or feeding trough is sometimes handy. This sketch shows details of forms for such a trough, and a sectional view of the finished trough in upright position.

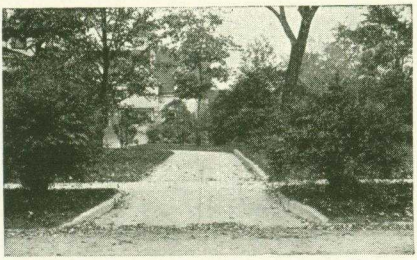
Concrete Fence Posts

Concrete fence posts will not rot or burn. They are uniform in size and shape and are easily set and lined up. They are a paying investment on the farm and an adornment on the home grounds.

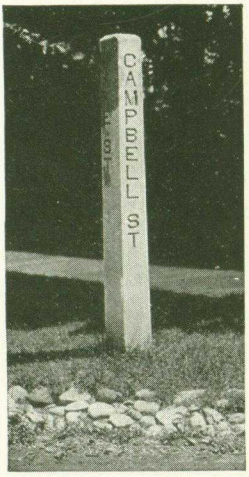
Posts should be made of either a 1:2:3 or a 1:2:2 mixture of portland cement, sand and pebbles not more than ¾ inch in size or a 1:3 mixture of portland cement and sand. If the concrete is not dense and well made the steel reinforcement will not be properly protected.

The correct location of reinforcement in posts is very important. Several types of posts with reinforcement are shown on page 26. The rods are located

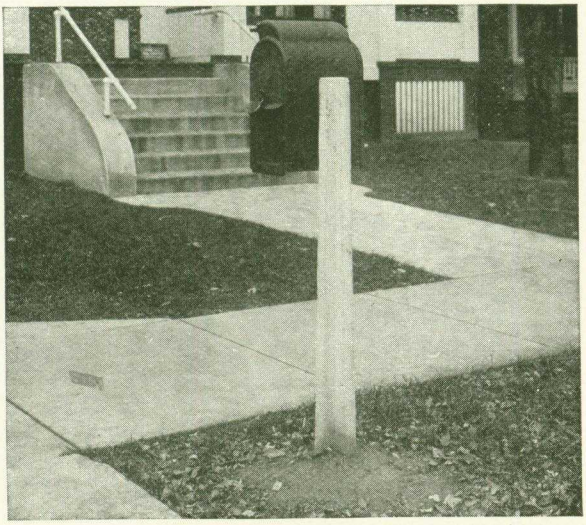
Concrete Around the Front Door



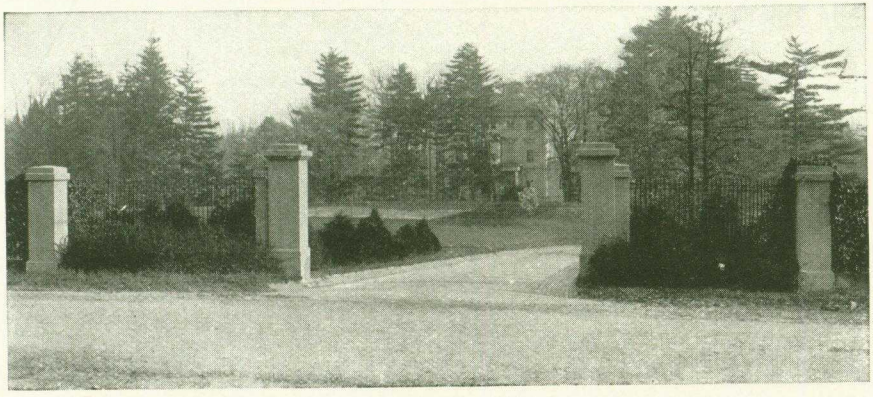
These neat concrete entrance drives extend a welcome that is hard to resist.



Visitors will find your house if there is a concrete sign post at your corner.



A good combination: front steps, walk and mail box post—all of concrete.

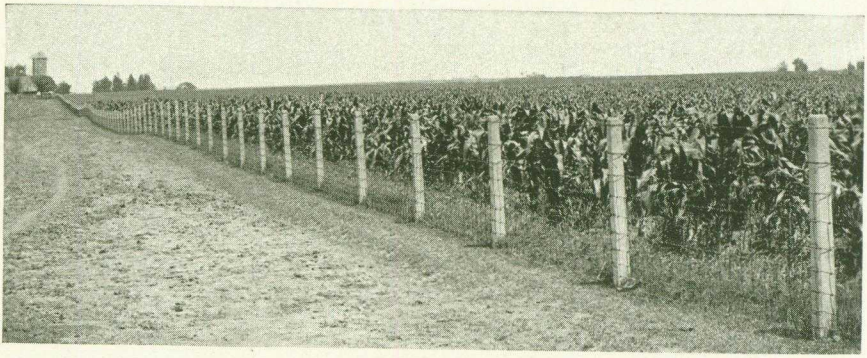


Concrete gate posts give a good "first impression" of the home grounds. They never get that run-down appearance.

near each corner where the greatest tensile stresses occur and from ½ to ¾ inch from the surface to protect them against possible exposure. Reinforcement in the center of the post is useless. Quarter-inch round or square steel rods have proved most satisfactory for reinforcing line posts.

A false impression entertained by some is that almost any kind of scrap wire, even barbed fence wire, will serve for reinforcement. Such wire is often so rusty or dirty that concrete will not stick to it and it is therefore useless. Wire is also usually purchased in coils and is difficult to straighten so that it will stay in the proper place while placing concrete. Economy of time and much greater certainty of successful results follow the use of steel rods.

An illustration on page 27 shows an easily made "gang mold" in which six posts are cast at one time. This mold makes posts 5 inches square at the



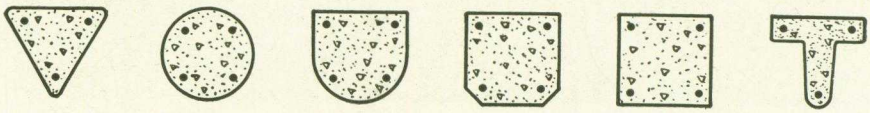
Concrete fence posts will not rot or burn and "stay put." Their neat appearance helps make the farm look trim.

bottom, tapering to 4 by 5 inches at the top and 7 feet long. The sides and ends are made of two-inch lumber and the partition strips of one-inch material.

Concrete is first placed about one inch deep in the molds. Then two reinforcing rods are laid in the concrete, one in each corner about ¾ inch from side and bottom. The mold is then filled with concrete to about ½ inch from the top and the other two reinforcing rods carefully embedded in it. The mold is then filled to the top and struck off and troweled. Concrete should be "spaded" as described on page 10 to insure dense, smooth surfaces on the posts.

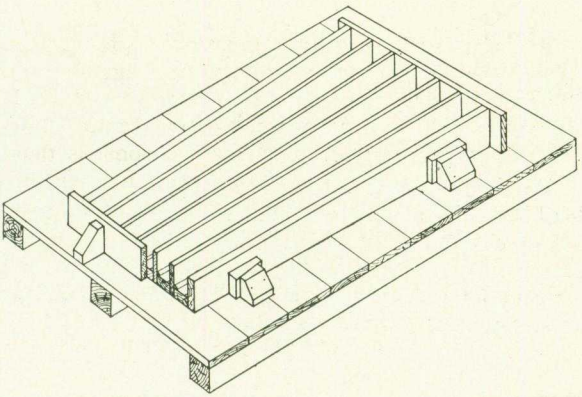
Posts should be protected from sun and wind by a covering of straw or damp sand and kept moist for a week or ten days after removal from molds so that they will harden properly.

Corner posts, mailbox posts and clothesline posts can be made in a similar manner.



Cross-sections of common types of fence posts. The square or nearly square shapes are the most popular. The black dots are steel reinforcing rods placed to give the greatest strength.

Concrete Block, Tile and Brick

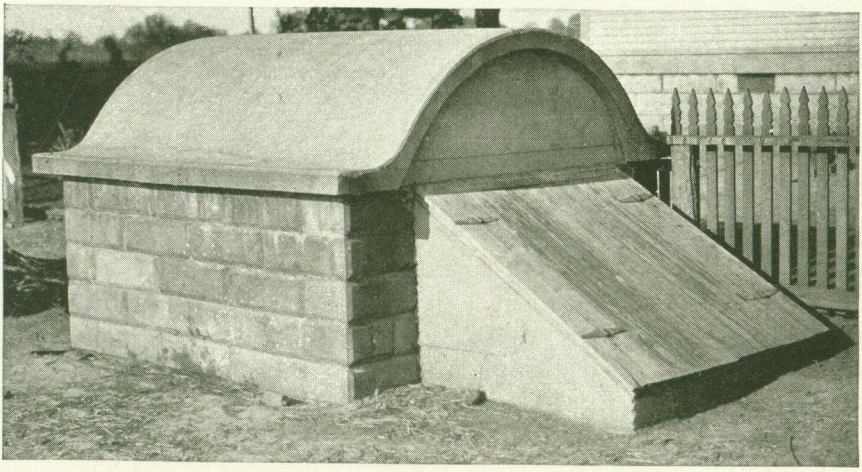


A gang mold in which six concrete fence posts may be cast at one time. A 1:2:3 mixture of concrete should be used and the reinforcement carefully placed.

Concrete block, tile and brick are fire resistive, are easily and economically laid and make buildings that will need no painting or repairing. These building units are suitable for all types of city and rural structures. Houses, garages, barns, poultry houses, and ice houses are but a few of the structures in which they are successfully used. Well equipped plants for making these units are located in most communities. As the equipment necessary to make and cure good products is usually more expensive than the average individual can afford to buy, it is better for him to buy his concrete building block, brick and tile from a plant than to attempt to make them himself.

Concrete block are made in a number of sizes, the 8 by 8 by 16-inch and 8 by 8 by 24-inch sizes being used most extensively. Smaller units called building tile are usually made in two sizes, 5 by 8 by 12-inch and 8 by 12 by 12-inch. Concrete brick are the same size as common brick.

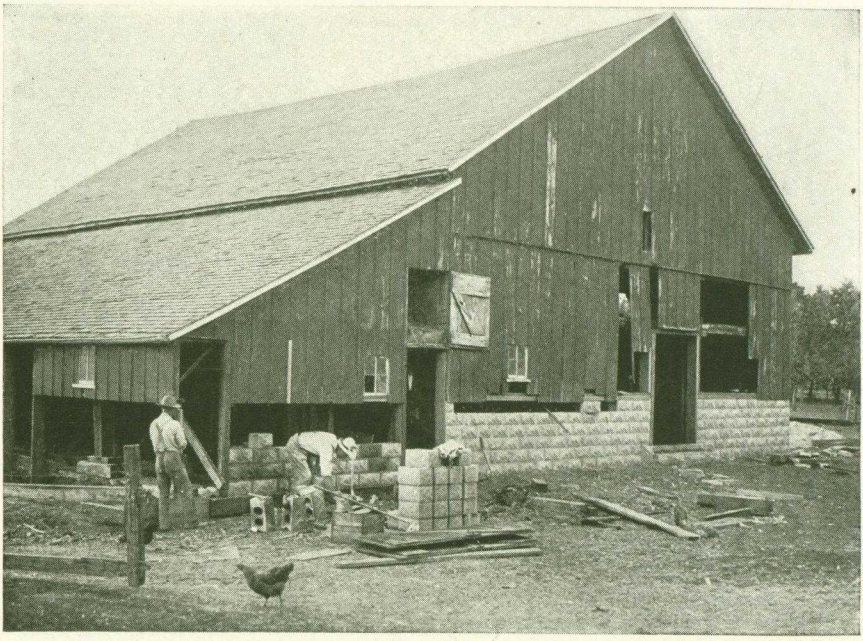
Concrete building units should be moistened before laying, by sprinkling with a hose. This wetting is necessary to prevent the dry block from absorbing the water from the fresh mortar and thereby interfering with the chemical process involved in the hardening of the mortar.



This concrete block structure makes a safe, dry, lasting shelter for the farm lighting plant.

Mortar joints should average from ¼ inch to ⅜ inch in thickness. To get a tight, strong, vertical joint, mortar should be applied with force and both ends of the block should be "buttered." As the horizontal or bed joints must carry the weight of the wall, the supporting sections should be well covered with mortar.

Portland cement mortar should be used for laying concrete units. It should be mixed in the proportion of one sack of portland cement to two cubic feet of clean, well graded sand. Hydrated lime is sometimes added to the mortar to make it "work" easier. It should never be used in excess of ten per cent by volume of the cement used. The use of more lime than this amount will weaken the mortar.



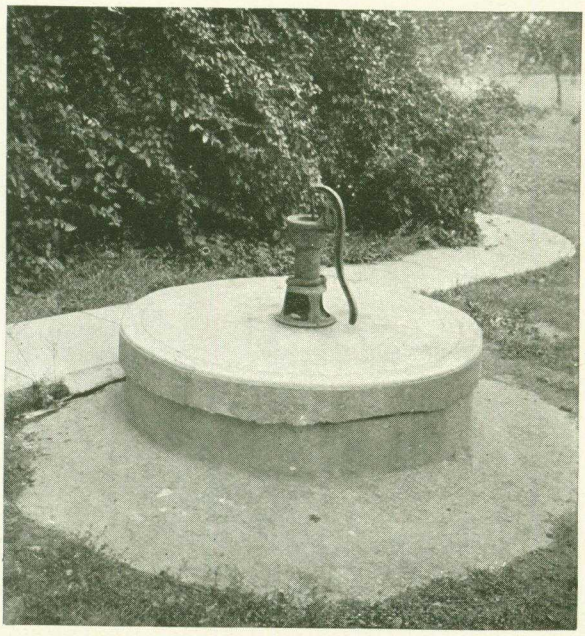
It is not difficult to place a concrete block foundation under a building whose sills have rotted away. Old buildings may be given a new lease of life with new walls of concrete block.

Other Concrete Work

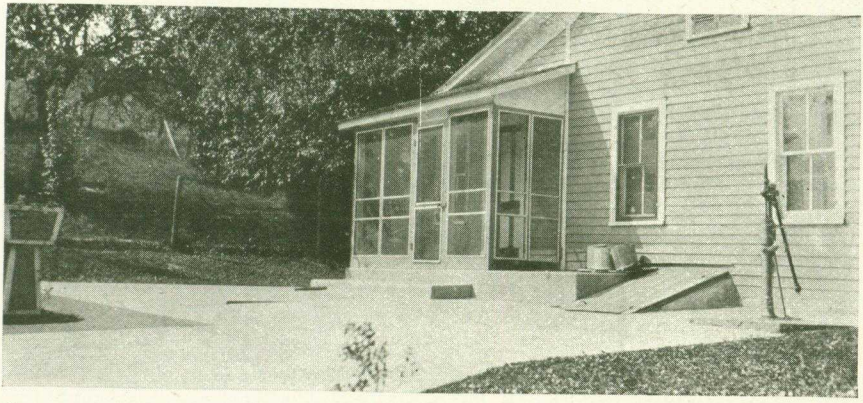
It is impossible, within the limited space of this booklet, to describe in detail the hundreds of uses to which concrete may be put in making permanent improvements around the home. A few of the many common uses of concrete are listed on page 3. These naturally suggest other and similar uses.

Remember that the principles of good concrete construction are the same for all kinds of concrete work. Do not fail to read this booklet carefully; then save it for future reference.

Booklets that explain and illustrate almost every use of concrete from the smallest farm or home improvement to the modern concrete factory or office building are published by the Portland Cement Association. Copies of booklets on any phase of concrete construction in which the reader is interested may be obtained free by addressing the Portland Cement Association, 111 West Washington Street, Chicago. More detailed information on the many uses and proper methods of making concrete may also be obtained in the same manner. It is hardly likely that you will ever have any building problem that can not be satisfactorily met by the proper use of concrete.



The dollars you invest in a concrete cistern will bring you genuine satisfaction in a supply of clean, soft water.



Concrete walks and pavement in the back yard make it as easily kept clean and orderly as the parlor.

How to Figure Amount of Cement and Aggregates to Be Used

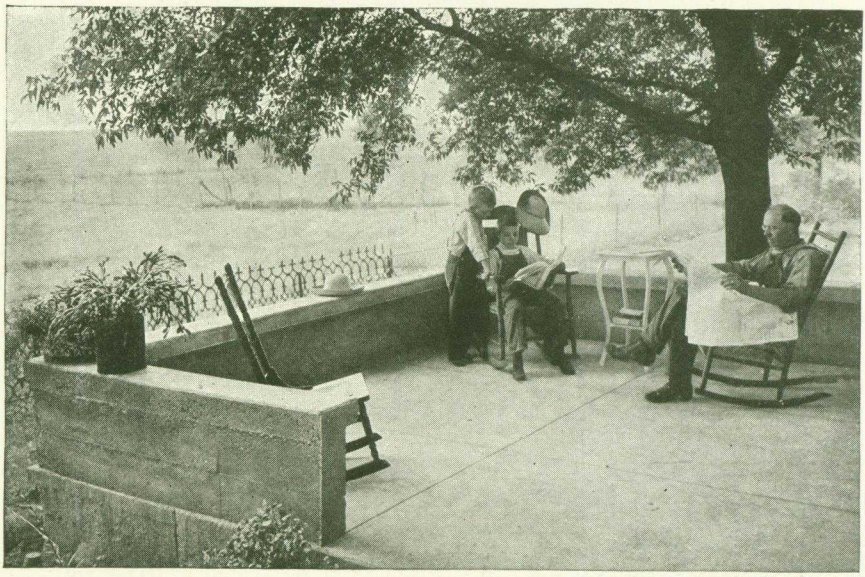
The table on the opposite page can be readily used for figuring the amount of material that is needed for any concrete structure. Suppose, for example, that we want to build a walk 50 feet long, 5 feet wide and 5 inches thick, using a 1:2:3 concrete mixture. 50 x 5 = 250 square feet of surface.

In the left-hand column of the table we find under thickness: "5." Directly across the page to the right in the column headed 1:2:3 we find that it requires 108 sacks of portland cement, 216 cubic feet of sand and 322 cubic feet of pebbles to make 1,000 square feet of sidewalk 5 inches thick.

As the area of the sidewalk is but ¼ of 1,000 it will require but ¼ this quantity of materials to build it.

Therefore,

108 x ¼ = 27 sacks of portland cement.
216 x ¼ = 54 cubic feet of sand.
322 x ¼ = 80½ cubic feet of pebbles.



There is solid comfort in a concrete porch. It is cool and clean and costs nothing for repairs.

As another example suppose that it is desired to estimate the material for a wall 4 feet high, 125 feet long and ten inches thick, using a 1:2½:4 mixture for the concrete.

4 x 125 = 500 square feet of surface in the wall.

In the line for a 10-inch wall under the column for a 1:2½:4 mixture we find the following quantities: Cement, 172; fine aggregate, 430; coarse aggregate, 686.

The table gives quantities for 1,000 square feet of surface. Our wall has only half that much—500 square feet. Taking half of the quantities shown we have for our wall: Cement, 86 cubic feet (86 sacks); fine aggregate, 215 cubic feet; coarse aggregate, 343 cubic feet.

Materials Required for 1,000 Sq. Ft. of Surface for Varying Thicknesses of Concrete or Mortar

C. = Cement in Sacks.
F.A. = Fine Aggregate (Sand) in Cu. Ft.
C.A. = Coarse Aggregate (Pebbles or Broken Stone) in Cu. Ft.

Quantities may vary 10 per cent either way according to aggregate used.
No allowance made for waste.

Thickness in Inches	PROPORTION																							
	1:1½		1:2		1:2½		1:3		1:1:1½			1:2:3			1:2:4			1:2½:4			1:2½:5		
	C.	F.A.	C.	F.A.	C.	F.A.	C.	F.A.	C.	F.A.	C.A.	C.	F.A.	C.A.	C.	F.A.	C.A.	C.	F.A.	C.A.	C.	F.A.	C.A.
⅜	18	27	15	30	13	32	11	34															
½	24	36	20	40	17	43	15	44	18	18	27												
¾	36	54	30	60	25	63	22	68	27	27	41												
1	48	72	40	79	34	84	30	89	37	37	55												
1¼	60	90	49	99	42	105	37	111	46	46	68												
1½	72	108	59	119	51	127	44	133	55	55	82												
1¾	84	126	69	139	59	147	52	157	64	64	97												
2	96	144	79	158	68	169	59	177	73	73	111												
3												65	130	193	56	112	224	52	129	206	46	115	230
4												86	172	258	75	149	298	69	171	275	62	154	307
5												108	216	322	94	187	374	86	215	343	77	192	383
6												129	258	386	112	224	447	103	258	412	92	230	459
8												172	344	516	150	298	597	137	343	549	123	307	613
10												215	432	644	187	374	748	172	430	686	153	383	766
12												258	516	772	224	447	894	206	516	824	184	459	918

Portland Cement Association—
A National Organization to Improve and Extend the Uses of Concrete—Offers You Its Services

Durability, Fire-safety, Sanitation and Economy are qualities characteristic of well-built concrete structures. We place at your disposal **definite information on the use of concrete** so that these results will be assured.

Our District Offices listed below are service organizations. **Get their help in your concrete problems.** In addition you are invited to correspond with our headquarters, 111 West Washington Street, Chicago, where our engineers specialize in the application of concrete to

Farm Improvements
Home Building
Sanitary Improvements
Roads and Streets
Railway Construction
Industry and Commerce

These engineers are constantly in touch with the extensive researches being made by the various government bureaus, and by the Structural Materials Research Laboratory, operated jointly by us and the Lewis Institute, Chicago. Their recommendations are based on the most advanced information obtainable.

Educational booklets and pamphlets fully illustrating and describing the important uses of concrete await your request. Consult us freely.

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